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The Effects of Differential Prenatal and Postnatal Social Environments on Sexual Maturation of Young Prairie Deermice

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THE EFFECTS OF DIFFERENTIAL PRENATAL AND POSTNATAL SOCIAL ENVIRONMENTS ON SEXUAL MATURATION OF YOUNG PRAIRIE DEERMICE

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ABSTRACT

The present experiment was designed to compare the influence of differential social environments on sexual maturation of young Prairie Deermice (Peromyscus maniculatus bairdii). Males with pregnant females were used to found 43 bisexual pairs and 12 populations consisting of 4 bisexual pairs from different litters. Both populations and pairs occupied metal enclosures of 1829.22 $cm.^2$ floor area provided with wood shavings, excess food and water, and 4 plastic nest boxes. First litters were removed within 24 hours after birth. Subsequent litters were treated in the following manner 12-48 hours after parturition. One half of a litter from a population was exchanged with one half of a litter from a bisexual pair. In each situation the remaining half litters served as controls for the exchange procedure. Necessary adjustments were made to regulate litter size to 4-6 young per female, resulting in a maximum of 6 young per bisexual pair and 24 young per population. When the youngest experimental mouse in each enclosure reached 100 days of age, all the mice were chlorofomed and the weights of the body, adrenal glands, and reproductive organs were determined.

The results indicated that the testes and vesicular weights of population-reared males were significantly larger than those of males reared by bisexual pairs, irrespective of prenatal environment. Generally, females reared in populations exhibited the same phenomenon but their reproductive organs (ovaries and uteri plus oviducts) were not significantly larger than those reared by bisexual pairs. Males reared in either populations or by bisexual pairs did not differ significantly in absolute or relative adrenal weights, but females reared by bisexual pairs had significantly larger absolute and relative adrenals than females reared in populations.

Possible explanations for the differences in results between this experiment and past population research are discussed.

THE EFFECTS OF DIFFERENTIAL PRENATAL AND POSTNATAL SOCIAL ENVIRONMENTS ON SEXUAL MATURATION OF YOUNG PRAIRIE DEERMICE

INTRODUCTION

Populations of several species of small mammals when maintained under constant laboratory conditions and provided with excess food and water control their growth as a result of variable intrinsic factors (Calhoun, 1950; Brown, 1953; Southwick, 1955; Christian, 1956a; Chitty, 1960; Helmreich, 1960; Terman, 1965, 1969, 1972c; Bailey, 1966).

Studies of freely growing Prairie Deermice (Peromyscus maniculatus bairdii) reveal that population growth is curtailed either by cessation of reproduction or by failure of the young to survive, the former method being the more frequent mechanism. About 80-95% of the females born into, and surviving in, freely growing populations fail to produce young. Further, the reproductive organs of males and females from these asymptotic populations are significantly lighter than those of bisexually-paired controls (Terman, 1965).

Subsequent research (Terman, 1972a) has shown that this reproductive inhibition phenomenon is not permanent. When sexually inhibited males and females were removed from asymptotic populations and paired with fertile mates, a high percentage eventually became reproductive. This experiment emphasized the importance of the postnatal environment on reproductive inhibition or maturation. The results of crowding and maternal stress experiments with small mammals (Thompson, 1957; Christian and Lemunyan, 1958; Keeley, 1962; Thompson, et. al., 1962; Wehmer, et. al., 1970) however, suggest that the prenatal environment strongly influences the postnatal behavior.

The purpose of the present experiment was to compare the influence of differential social environments on sexual maturation of young mice. Specifically, the objectives were:

1. to compare the effects of the prenatal and the postnatal population and bisexual pair environments on sexual maturation of mice as measured by reproductive rates and organ weights.

2. to note the influence of those differential prenatal and postnatal social environments on the weights of the paired adrenal glands.

3. to observe the effects of cross-fostering *per se* on reproductive maturation of sibs.

METHODS

Animals

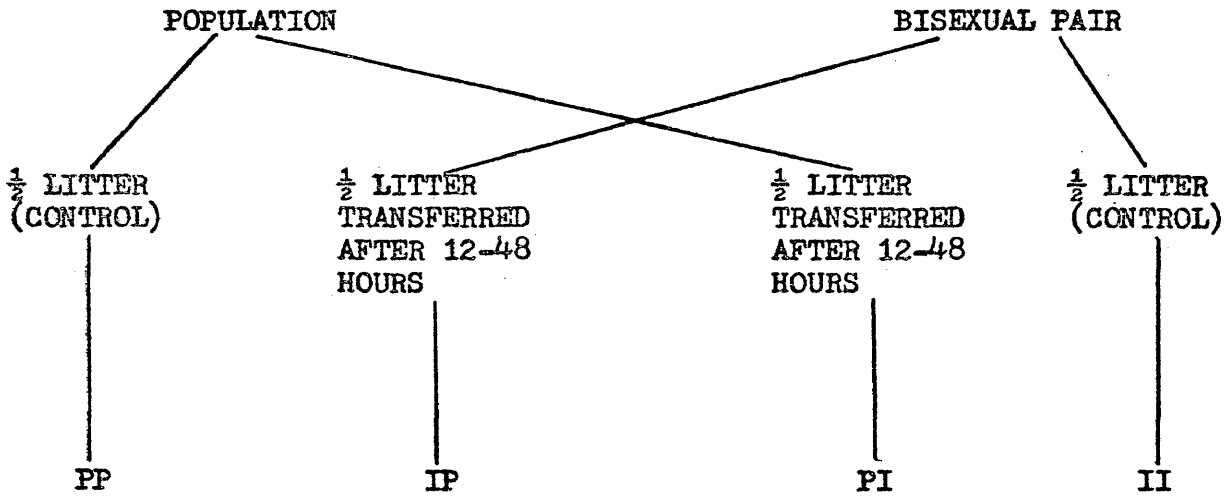
The animals used in this experiment were Prairie Deermice (Peromyscus maniculatus bairdii) whose ancestors were field caught and maintained as a laboratory colony for approximately 14 years during which time sib matings were not permitted. Wild caught animals were added to the colony once per year when possible during the past 7 years in an attempt to maintain a heterogeneous gene pool. Mice were reared as bisexual pairs from weaning (21 days) until approximately 14 weeks of age. Males with pregnant females were used to found 43 bisexual pairs and 12 populations consisting of 4 bisexual pairs from different litters. Populations and bisexual pairs occupied corrugated, galvanized steel garbage cans (diameter, 48.26 cm.; floor area, 1829.22 $cm.^2$) provided with wood shavings, excess D & G food and tap water, and 4 plastic nest boxes. All animals were maintained in 15 x 15 ft. rooms lighted daily by four 40-watt fluorescent bulbs from 0730 hours to 1930 hours, and by four 15-watt light bulbs from 1930 hours to 0730 hours. Temperature in the experimental rooms ranged from 21-30°C. Founders were toe-clipped for identification, and first litters born in each treatment situation were removed within 24 hours in order to eliminate the possibility of variable prenatal experiences. Subsequently, the mice were inspected daily until second litters were born.

Design

As illustrated in Figure 1, 12-48 hours after parturition one half

FIGURE 1

Experimental Design. See text for detailed discussion.



Number of Animals--32
(8 Founders, 24 Young)

Number of Animals--6-8
(2 Founders, 4-6 Young)

of a litter from a population was exchanged with one half of a litter from a bisexual pair. In each situation the remaining half litters served as controls for the exchange procedure.

Preparatory to cross-fostering, the size of litters born to bisexual pairs was adjusted to 4-6 young per female; any number of young above this criterion were removed. However, the same litter adjustments were impossible to make in the populations since litters born at approximately the same time were grouped in a common nest box. Consequently, the total litter size in each population was adjusted to 24 young, theoretically allowing a maximum of 6 young per female. The young in both experimental situations were toe-clipped and sexed, and each litter was equally divided for exchange according to number and sex insofar as this was possible.

Asynchronous parturition in population and bisexual pair females posed problems to the design. In an attempt to eliminate age and density variables, cross-fostering was terminated after approximately two months. After this time some of the populations still had not reached maximum density, although they did contain some cross-fostered young. Consequently, subsequent young were left in these populations until a total of 24 young was reached, but the organs of these younger mice were not used in the final analysis. Mice born to any females subsequent to fixed maximum density in an enclosure were recorded and removed.

Every two weeks wood shavings in the enclosures were changed, females were inspected for vaginal opening and/or pregnancy, and scrotal or nonscrotal testes were noted in males. When the youngest experimental mouse in each enclosure reached 100 days of age, all the mice were chloroformed and weighed to the nearest 0.1 gram. The maximum age span

for young in each treatment situation was from 100-140 days. Testes, vesicular glands, and adrenals were removed from all experimental males, and adrenals, ovaries, and uteri plus oviducts were removed from all experimental females. In addition, the uteri were checked for embryos or scars. The organs for each mouse were preserved in a 10% formalin solution, following which they were cleaned of extraneous tissue, blotted, and weighed twice to the nearest 0.01 milligram on a Sartorius balance.

RESULTS

The following abbreviations will be used throughout the text to indicate the four types of experimental situations:

PP refers to mice born and reared in populations
IP refers to mice born to bisexual pairs and reared in populations
PI refers to mice born in populations and reared by bisexual pairs
II refers to mice born to and reared by bisexual pairs

The means and grand means of the weights of the body, absolute and relative paired adrenal glands, testes, and vesicular glands for PP, IP, PI, and II males are listed in Appendix Tables A, B, C, and D respectively. The means and grand means of the body weights and the weights of the absolute and relative paired adrenal glands, ovaries, and uteri plus oviducts for PP, IP, PI, and II nulliparous females are listed in Appendix Tables E, F, G, and H respectively.

Analysis of Variance

An analysis of variance was made for the mean body and organ weights of males and nulliparous females in order to test for possible interactions in each treatment between cross-fostered and native mice. A summary of the results is presented in Appendix Table I for males and Appendix Table J for nulliparous females.

Males: There were no significant interaction or prenatal effects for any of the male mean organ weight comparisons. Sampling and rearing effects were responsible for the major percentage of variance.

Females: All F ratios were nonsignificant at the 5% level for mean body and organ weights of the nulliparous females. However, the prenatal

environment appeared to contribute more to the variance than either the postnatal, interaction, or sampling effects.

Hartley's F_{max} test which compares the largest and smallest sample variances was used to test the hypothesis of homogeneous variances for males and nulliparous females respectively (Appendix Table K). Although the F_{max} values were significant at the 1% level for male mean body, testes, and vesicular weights and female uteri plus oviduct weights, a nonparametric statistical analysis was deemed unnecessary. This decision was based on Boneau's (1960) findings that there is only a remote possibility of making either a Type I or a Type II error with slightly significant F values.

T Test Comparisons

Individual mean body and organ weight comparisons were analyzed with t tests, and the results will be discussed with respect to the different experimental manipulations of prenatal and postnatal social environments.

Same Prenatal and Same Postnatal Environment

Table 1 presents the results of t test comparisons between PP and II males and nulliparous females respectively for the mean weights of the body, absolute and relative paired adrenal glands, and reproductive organs and their standard errors.

Males: There were no significant differences in body, absolute adrenal, or relative adrenal weights in the comparisons of PP and II males. Relative adrenal weights were calculated on the basis of the paired absolute adrenal weights per 100 grams of body weight. PP males had significantly larger testes weights (<0.025) and vesicular weights (<0.05) than II males.

Table 1. T test comparisons of the mean body (gm.) and organ weights (mg.) and their standard errors of PP versus II males and nulliparous females respectively.

Sex	Comparisons	Body Wt.			Absolute Adrenals			Relative Adrenals			Testes or Ovaries			Vesiculars or Uteri Plus Oviducts		
		n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P
Males	PP	12	15.61 ± 0.41	NS	12	2.17 ± 0.13	NS	12	13.94 ± 0.60	NS	12	223.16 ± 15.27	<0.025	12	95.59 ± 12.15	<0.05
	II	23	14.76 ± 0.54		23	2.10 ± 0.10		23	14.54 ± 0.91		22	158.01 ± 17.32		23	56.33 ± 10.98	
Null. Females	PP	12	12.47 ± 0.28	NS	12	2.18 ± 0.11	NS	12	17.52 ± 1.24	NS	12	5.05 ± 0.51	NS	12	14.59 ± 1.77	NS
	II	21	13.27 ± 0.41		20	2.14 ± 0.08		20	16.16 ± 0.66		21	5.04 ± 0.50		21	16.15 ± 2.90	

Females: None of the PP versus II female organ weight comparisons revealed any significant differences.

Same Prenatal, Different Postnatal Environment

T test comparisons of the mean body and organ weights and their standard errors of PP versus PI and II versus IP males and nulliparous females respectively are presented in Table 2.

Males: PP males had significantly larger body weights (<0.01), testes weights (<0.001), and vesicular weights (<0.025) than PI males, but there were no significant differences between their absolute and relative paired adrenal weights. Statistical comparisons between II and IP males showed slightly significant differences in body weights (<0.1) and vesicular weights (<0.1), and nonsignificant differences in adrenal and testes weights. In all mean weight comparisons except relative adrenals, the IP males were larger.

Females: None of the comparisons of mean organ weights between PP and PI females showed any significant differences. II and IP comparisons revealed significantly larger II absolute adrenals (<0.05) and relative adrenals (<0.05), and smaller II uterus plus oviduct weights (<0.1). Ovarian and body weights showed no significant differences.

Different Prenatal, Same Postnatal Environment

Table 3 presents the summary of t test comparisons of mean organ and body weights and their standard errors between PP versus IP and II versus PI males and nulliparous females respectively.

Males: None of the body and organ weight comparisons showed significant differences between PP and IP males or between II and PI males.

Females: In the PP versus IP comparisons, there were no significant differences in ovary weights, but IP females had significantly larger

Table 2. T test comparisons of the mean body (gm.) and organ weights (mg.) and their standard errors of PP versus PI and II versus IP males and nulliparous females respectively.

Sex	Comparisons	Body Wt.			Absolute Adrenals			Relative Adrenals			Testes or Ovaries			Vesiculars or Uteri Plus Oviducts		
		n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P
Males	PP	12	15.61 ± 0.41	<0.01	12	2.17 ± 0.13	NS	12	13.94 ± 0.60	NS	12	223.16 ± 15.27	<0.001	12	95.59 ± 12.15	<0.025
	PI	27	14.25 ± 0.28		26	2.14 ± 0.09		26	15.11 ± 0.51		27	149.82 ± 10.42		27	53.69 ± 9.91	
	II	23	14.76 ± 0.54	<0.1	23	2.10 ± 0.10	NS	23	14.54 ± 0.91	NS	22	158.01 ± 17.32	NS	23	56.33 ± 10.98	<0.1
	IP	11	16.48 ± 0.60		11	2.31 ± 0.12		11	14.46 ± 0.38		10	200.92 ± 10.66		11	85.21 ± 7.23	
Null. Females	PP	12	12.47 ± 0.28	NS	12	2.18 ± 0.11	NS	12	17.52 ± 1.24	NS	12	5.05 ± 0.51	NS	12	14.59 ± 1.77	NS
	PI	18	12.96 ± 0.38		18	2.16 ± 0.09		18	16.19 ± 0.86		18	4.97 ± 0.56		18	14.09 ± 2.94	
	II	21	13.27 ± 0.41	NS	20	2.14 ± 0.08	<0.05	20	16.16 ± 0.66	<0.05	21	5.04 ± 0.50	NS	21	16.15 ± 2.90	<0.1
	IP	12	13.39 ± 0.28		12	1.89 ± 0.08		12	13.89 ± 0.62		12	5.94 ± 0.38		12	23.66 ± 3.18	

Table 3. T test comparisons of the mean body (gm.) and organ weights (mg.) and their standard errors of PP versus IP and II versus PI males and nulliparous females respectively.

Sex	Comparisons	Body Wt.			Absolute Adrenals			Relative Adrenals			Testes or Ovaries			Vesiculars or Uteri Plus Oviducts		
		n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P
Males	PP	12	15.61 ± 0.41	NS	12	2.17 ± 0.13	NS	12	13.94 ± 0.60	NS	12	223.16 ± 15.27	NS	12	95.59 ± 12.15	NS
	IP	11	16.48 ± 0.60		11	2.31 ± 0.12		11	14.46 ± 0.38		10	200.92 ± 10.66		11	85.21 ± 7.23	
	II	23	14.76 ± 0.54	NS	23	2.10 ± 0.10	NS	23	14.54 ± 0.91	NS	22	158.01 ± 17.32	NS	23	56.33 ± 10.98	NS
	PI	27	14.25 ± 0.28		26	2.14 ± 0.09		26	15.11 ± 0.51		27	149.82 ± 10.42		27	53.69 ± 9.91	
Null. Females	PP	12	12.47 ± 0.28	<0.05	12	2.18 ± 0.11	<0.05	12	17.52 ± 1.24	<0.025	12	5.05 ± 0.51	NS	12	14.59 ± 1.77	<0.025
	IP	12	13.39 ± 0.28		12	1.89 ± 0.08		12	13.89 ± 0.62		12	5.94 ± 0.38		12	23.66 ± 3.18	
	II	21	13.27 ± 0.41	NS	20	2.14 ± 0.08	NS	20	16.16 ± 0.66	NS	21	5.04 ± 0.50	NS	21	16.15 ± 2.90	NS
	PI	18	12.96 ± 0.38		18	2.16 ± 0.09		18	16.19 ± 0.86		18	4.97 ± 0.56		18	14.09 ± 2.94	

body weights (<0.05), and uterus plus oviduct weights (<0.025), and PP females had significantly larger absolute adrenals (<0.05) and relative adrenals (<0.025). Body and organ weight comparisons between II and PI females revealed no significant differences.

Different Prenatal and Different Postnatal Environment

The results of t test comparisons of the mean body and organ weights and their standard errors of IP versus PI males and nulliparous females respectively are presented in Table 4.

Males: IP males were significantly larger in body weights (<0.001), testes weights (<0.01), and vesicular weights (<0.1) than PI males, while the adrenal weights showed no significant differences.

Females: No significant differences resulted from the comparisons of mean body and ovary weights between IP and PI nulliparous females, but significant differences did occur in absolute adrenals (<0.05), relative adrenals (<0.1), and uterus plus oviduct weights (<0.05). PI females had larger absolute and relative adrenal weights but smaller uteri than IP females.

Prenatal/Postnatal Effects--Grouped Treatments

Grouping treatment animals to test for possible prenatal effects (PP-PI versus II-IP) and cross-fostering effects (PP-II versus PI-IP) showed no significant differences in the weight measurements for males or nulliparous females (Table 5).

T test comparisons of PP-IP versus II-PI grouped males (Table 5), however, showed significant postnatal effects on body weights (<0.005), testes weights (<0.001), and vesicular weights (<0.005). Males reared in populations, irregardless of prenatal experience, had larger reproductive organs than males reared by bisexual pairs. Comparisons of

Table 4. T test comparisons of the mean body (gm.) and organ weights (mg.) and their standard errors of IP versus PI males and nulliparous females respectively.

Sex	Comparisons	Body Wt.			Absolute Adrenals			Relative Adrenals			Testes or Ovaries			Vesiculars or Uteri Plus Oviducts		
		n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P
Males	IP	11	16.48 ± 0.60	<0.001	11	2.31 ± 0.12	NS	11	14.46 ± 0.38	NS	10	200.92 ± 10.66	<0.01	11	85.21 ± 7.23	<0.1
	PI	27	14.25 ± 0.28		26	2.14 ± 0.09		26	15.11 ± 0.51		27	149.81 ± 10.42		27	53.69 ± 4.61	
Null. Females	IP	12	13.39 ± 0.28	NS	12	1.89 ± 0.08	<0.05	12	13.89 ± 0.62	<0.1	12	5.94 ± 0.38	NS	12	23.66 ± 3.18	<0.05
	PI	18	12.96 ± 0.38		18	2.16 ± 0.09		18	16.19 ± 0.86		18	4.97 ± 0.56		18	14.09 ± 2.94	

Table 5. T test comparisons of the mean body (gm.) and organ weights (mg.) and their standard errors for the prenatal environment (PP-PI versus II-IP), cross-fostering *per se* (PP-II versus PI-IP), and the postnatal environment (PP-IP versus II-PI) males and nulliparous females respectively.

Sex	Comparisons	Body Wt.			Absolute Adrenals			Testes or Ovaries			Vesiculars or Uteri Plus Oviducts		
		n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P
Males	PP-PI	39	14.67 ± 0.24	NS	38	2.15 ± 0.07	NS	39	172.38 ± 10.11	NS	39	66.58 ± 8.34	NS
	II-IP	34	15.32 ± 0.43		34	2.17 ± 0.08		32	171.42 ± 12.76		34	65.67 ± 8.06	
Null. Females	PP-PI	30	12.76 ± 0.24	NS	30	2.17 ± 0.07	NS	30	5.01 ± 0.39	NS	30	14.29 ± 1.87	NS
	II-IP	33	13.31 ± 0.26		32	2.05 ± 0.06		33	5.37 ± 0.36		33	18.88 ± 2.24	
Males	PP-II	35	15.05 ± 0.38	NS	35	2.13 ± 0.08	NS	34	181.00 ± 13.43	NS	35	69.79 ± 8.82	NS
	PI-IP	38	14.89 ± 0.30		35	2.19 ± 0.07		37	163.63 ± 8.90		38	62.81 ± 7.66	
Null. Females	PP-II	33	12.98 ± 0.28	NS	32	2.16 ± 0.07	NS	33	5.05 ± 0.37	NS	33	15.58 ± 1.94	NS
	PI-IP	30	13.13 ± 0.24		30	2.05 ± 0.07		30	5.36 ± 0.37		30	17.92 ± 2.31	
Males	PP-IP	23	16.03 ± 0.36	<0.005	23	2.24 ± 0.09	NS	22	213.06 ± 9.73	<0.001	23	90.63 ± 7.14	<0.005
	II-PI	50	14.48 ± 0.28		49	2.12 ± 0.07		49	153.50 ± 9.58		50	54.91 ± 7.28	
Null. Females	PP-IP	24	12.93 ± 0.22	NS	24	2.04 ± 0.07	NS	24	5.50 ± 1.18	NS	24	19.12 ± 2.01	NS
	II-PI	39	13.12 ± 0.28		38	2.15 ± 0.06		39	5.01 ± 0.88		39	15.20 ± 2.04	

PP-IP versus II-PI nulliparous females revealed no significant postnatal effects on mean organ weights.

Pregnancy Rates

Chi square tests were used to analyze pregnancy rates among females in the four experimental situations. A summary of the results is presented in Table 6. All comparisons were nonsignificant, although in the PI versus IP comparisons, PI females had higher pregnancy rates than IP females (<0.1).

Starvation Stress

Due to an oversight during the course of the experiment, thirteen bisexual pairs were left unfed for approximately one week. The young mice were about 30 days old at the time. Although gross physical differences were not apparent in the animals, they were not used in the final analysis of variance, Hartley's F_{max} test, t test, or chi square analyses. However, a separate t test analysis of their mean organ and body weights was made.

Appendix Tables L and M present the mean body and organ weights of the starved males and nulliparous females respectively. T test comparisons made between starved (S) and nonstarved (N) male and nulliparous female mice respectively yielded some interesting and fairly consistent results (Appendix Table N).

Males: Testes weights of starved PI males were larger than those of nonstarved PI males at the $0.1 > P > 0.05$ level of significance only. Although the comparisons of their body, adrenal, and vesicular weights showed no significant differences, the PI starved males had consistently larger mean body and vesicular weights and smaller absolute and relative

Table 6. Chi square analysis of the pregnancy rates of PP, IP, PI, and II females.

Comparisons	Born	Reared	Total Females	Pregnant	% Pregnant	Chi Square	P
Same Prenatal, Same Postnatal	I	I	44	9	20.5		
	P	P	57	14	24.6		
Total			101	23	22.8	0.5289	NS*
Same Prenatal, Different Postnatal	I	I	44	9	20.5		
	I	P	43	7	16.3		
Total			87	16	18.4	0.0510	NS
	P	P	57	14	24.6		
	P	I	33	10	30.3		
Total			90	24	26.7	0.7071	NS
Different Prenatal, Same Postnatal	I	P	43	7	16.3		
	P	P	57	14	24.6		
Total			100	21	21.0	1.5742	NS
	P	I	33	10	30.3		
	I	I	44	9	20.5		
Total			77	19	24.7	0.5255	NS
Different Prenatal, Different Postnatal	I	P	43	7	16.3		
	P	I	33	10	30.3		
Total			76	17	22.4	2.9994	<0.1

*Significant at $P<0.01$.

adrenal weights than PI nonstarved males. II starved males were significantly larger than II nonstarved males in testes weights (<0.05). There were no significant differences in body, adrenal, or vesicular weights, but the II starved males had larger mean body, absolute adrenal, and vesicular weights than II nonstarved males.

Females: Starved versus nonstarved nulliparous females in both PI and II treatment situations showed no significant differences, but the absolute adrenal weights of the PI nonstarved females were larger (<0.1) than those of the PI starved females.

DISCUSSION

The data indicate that the postnatal population environment did not inhibit, and may have stimulated, sexual maturation in male prairie deermice irrespective of prenatal environment. The testes and vesicular weights of population-reared males were significantly larger than those of males reared by bisexual pairs. Generally, population-reared females exhibited the same phenomenon but their reproductive organs (ovaries and uteri plus oviducts) were not significantly larger than those of females reared by bisexual pairs.

The main difference between male and female reactions to differential social environments was evidenced by the absolute and relative adrenal weights. Irrespective of prenatal history, males reared in either populations or by bisexual pairs did not differ significantly in absolute and relative adrenal weights. However, females reared by bisexual pairs had significantly larger absolute and relative adrenal weights than females reared in populations.

The findings that the population environment does not inhibit sexual maturation appear to contradict previous experiments with rodents. Terman (1968) found that the population environment significantly inhibited the growth of the reproductive organs of males and females from freely growing Peromyscus populations compared to those from bisexual pairs. Similar results were also observed in freely growing and fixed populations of House Mice, Mus musculus (Brown, 1953; Southwick, 1955; Christian, 1955b, 1956a), in experimental populations of albino mice

Christian and Lemunyan, 1958; Keeley, 1962), and in natural populations of voles, Clethrionomys rufocanus (Kalela, 1957), Norway Rats, Rattus norvegicus (Davis, 1953), and house mice (Evans, 1959).

The differences in results are difficult to explain but may be due to several differences in experimental design. The most pertinent comparisons can be made with Terman's Peromyscus experiments (1965, 1968, 1972c) during which there was no cross-fostering of young, the populations were freely growing to asymptote, the controls consisted of isolated bisexual pairs, and the populations and pairs were founded with nulliparous females. Whereas, in the present experiment, young were cross-fostered between populations and pairs, the populations of young were killed at 100-140 days of age, the controls were the non-fostered half litters left in the populations or in the bisexual pairs, and the populations and pairs were founded with only pregnant females.

It is not clear what interactions are responsible for the inhibitory reproductive effects demonstrated in Peromyscus populations. Possibly the interactions among the young, as well as those among the adults and the young, are important influences on reproductive organ size. A recent experiment by Terman (unpublished, 1972) was an attempt to clarify the importance of adults in producing the reproductive inhibition observed in population young. He founded 18 populations with four bisexual pairs of pregnant females, removed first litters at 21 days of age, and studied subsequent litters. When the second litters reached 21 days of age, the adults were removed from one half of the populations, and the other half of the populations remained intact as controls. The young were killed between 100-150 days of age, and their reproductive organs were cleaned and weighed. Terman observed that there was no

significant difference in reproductive organ weights between young growing in the absence of adults and young growing in the presence of adults. This study shows that, in terms of sexual maturation, the presence or absence of adults did not produce differential effects on the young before asymptote. Possibly the interactions among the young after cross-fostering altered the usual adult-young population interactions.

Another possible, and perhaps more likely, explanation of the results obtained is that the reproductive inhibitory effects present in a population at asymptote are not necessarily present before asymptote is reached. Terman (unpublished) compared the reproductive weights of young mice killed at 100 and 300 days of age from populations that had not reached asymptote to mice killed at 100 and 300 days of age from populations following asymptote. Although there was no significant difference in weights indicated by t value comparisons, he did find that animals killed before asymptote had consistently larger organ weights than those killed after asymptote. This study suggests that reproductive organ weights are heavier before asymptote, but it is by no means considered conclusive evidence since further experimentation in this area is still in progress.

Further, Christian (1956a), using house mice, founded 4 "high" populations, 2 "intermediate" populations in size, and isolated bisexual pair controls. The high populations were sacrificed when their growth curves appeared to be approaching asymptote, while populations of intermediate size were sacrificed when they reached a size estimated to be half that of their corresponding high population. Reproductive and adrenal weights for males and females revealed that the intermediate

populations had measurements midway between those for the control and high populations. Christian believes that the amount of stress and reproductive suppression in these mice were correspondingly about half the amount in high populations. These results suggest that reproductive organs are heavier before asymptote, and that reproductive inhibitory pressures become cumulatively greater as asymptote is approached.

The age at which the young are killed may also influence the size of reproductive organs. Gardner and Terman (1970) found that the size of reproductive organ weights of females maintained as bisexual pairs increased with age until 80 days, while similar controls killed at 100 days actually had smaller reproductive organs. These results indicate a fluctuation in reproductive organ weights during the female growth cycle and suggest that the age at which the mice were killed may have affected their reproductive organ size.

The adrenal weights likewise differed from those observed in previous experiments. The literature on adrenal glands generally indicates that relative adrenal weights increase with increasing density (Christian, 1955b; Southwick and Bland, 1959; Thiessen and Rodgers, 1961; Archer, 1969; Brain and Nowell, 1971), and the increase is not related to available food, water, or space for activity, but rather to the amount of social interaction between mice (Christian, 1955a, 1955b, 1956a, 1956b). However, in most of these experiments, mice were isolated before grouping. Since this was not the case in my experimental design where mice were grouped from infancy, it is possible that their gradual adaptations to the stress of social interactions did not reflect an increase in adrenal weights. Past experiments with Peromyscus, in particular, have shown no significant changes in adrenal weight (Bronson and Eleftheriou,

1963a; Terman, 1968, 1969, 1972c) or in adrenal ascorbic acid depletion (Bronson and Eleftheriou, 1963a) relative to density. Terman (1972c) believes that "the sensitivity by this species to ACTH may be so great that small quantities only are needed to produce the effect without increase in adrenal weights." The fact that pair-reared females had significantly larger absolute and relative adrenal weights than those reared in populations is contrary to Terman's observations (1968, 1969). However, since these mice also had smaller reproductive organs than the population-reared females, there is a consistency in the adrenal-gonadal relationship found in mice (Selye, 1946; Christian, 1955a, 1955b, 1956a, 1961, 1964).

It may be that the variables of cross-fostering the young, killing the young at 100-140 days of age and before asymptote was reached, using non-fostered population and pair young as controls, and founding populations and pairs with pregnant females added new dimensions to this experiment which consequently resulted in drastic changes from the observations of previous population research. Opposite results found in the adrenal weights may also be a reflection of these differences in experimental design.

APPENDIX

LIST OF APPENDICES

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Appendix A. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), testes (mg.), and vesicular glands (mg.) for PP males.

Replicates	Body Wt.	Adrenal Glands		Testes	Vesiculars
		Absolute	Relative		
PP 1 (6)*	14.6	2.20	15.46	211.82	80.46
PP 2 (2)	15.9	2.55	16.14	245.52	103.70
PP 3 (4)	16.3	2.24	13.87	231.39	90.21
PP 4 (5)	17.0	2.34	13.73	250.04	117.76
PP 5 (5)	15.4	2.15	14.11	204.44	93.04
PP 6 (4)	14.3	1.81	12.71	149.15	52.43
PP 7 (3)	15.1	1.51 (2)	10.21 (2)	274.50	99.93
PP 8 (5)	13.1	1.97	15.42	167.89(4)	60.70 (4)
PP 9 (4)	17.4	2.38	14.05	293.70	127.37
PP 10 (5)	14.7	1.92	13.41	165.44	52.04
PP 11 (4)	15.4	1.72 (1)	10.62 (1)	175.58	65.49
PP 12 (3)	18.2	3.28 (2)	17.66 (2)	308.49	204.03
n	12	12	12	12	12
Grand Mean	15.6	2.17	13.95	223.16	95.60

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix B. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), testes (mg.), and vesicular glands (mg.) for IP males.

Replicates	Body Wt.	Adrenal Glands		Testes	Vesiculars
		Absolute	Relative		
IP 1 (4)*	16.6	2.26	13.43	258.14	125.78
IP 2 (7)	14.6	2.04	14.70	147.22 (6)	41.23
IP 4 (5)	16.0	2.41 (2)	16.65 (2)	188.19	78.09
IP 5 (5)	17.2	2.31 (4)	14.74 (4)	190.07	96.49
IP 6 (5)	16.6	2.11 (3)	13.07 (3)	181.13	97.90
IP 7 (5)	16.0	1.98 (4)	13.38 (4)	232.70	89.85
IP 8 (6)	16.5	2.05	12.61	186.38	73.86
IP 9 (4)	15.6	2.27	14.87	244.99	116.16
IP 10 (6)	13.3	1.94 (5)	14.34 (5)	187.94	61.27
IP 11 (1)	21.3	3.13	14.69	------	83.86
IP 13 (6)	17.6	2.94 (5)	16.66 (5)	192.53	72.86
n	11	11	11	10	11
Grand Mean	16.5	2.31	14.47	200.93	85.21

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix C. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), testes (mg.), and vesicular glands (mg.) for PI males.

Replicates	Body Wt.	Adrenal Glands		Testes	Vesiculars
		Absolute	Relative		
PI 6 (1)*	13.5	1.99	14.74	183.36	41.76
PI 7 (2)	17.5	2.68	15.21	265.78	148.00
PI 8 (3)	15.1	2.30	15.35	203.88	117.57
PI 10 (3)	15.3	2.92 (2)	19.85 (2)	129.67 (2)	75.51
PI 13 (2)	15.2	2.34	15.52	188.06	127.48
PI 16 (1)	12.9	2.37	18.37	90.31	5.35
PI 17 (2)	14.3	2.29	16.13	206.31	51.99
PI 20 (1)	14.3	1.79	12.52	146.13	21.80
PI 21 (1)	13.2	1.70	12.88	127.48	41.07
PI 24 (1)	11.7	2.08	17.78	128.16	4.81
PI 34 (2)	11.6	2.07	17.84	99.92	12.30
PI 35 (2)	13.5	1.82	13.53	184.23	57.40
PI 39 (2)	17.8	2.17	12.00	270.05	215.72
PI 52 (2)	14.8	2.09	14.27	202.04	49.11
PI 53 (2)	13.0	1.79	14.14	95.81	16.32
PI 56 (1)	12.3	2.01	16.34	184.95	71.02
PI 57 (2)	14.9	3.56	21.98	175.28	47.18
PI 58 (1)	14.9	2.76	18.52	194.52	68.49
PI 61 (2)	14.3	1.66	11.54	91.21	9.53
PI 62 (2)	13.9	1.68	12.06	79.42	8.43
PI 63 (3)	14.8	1.87	12.59	86.57	11.03
PI 65 (2)	13.4	1.91	14.30	119.68	20.92
PI 66 (2)	13.5	1.98	14.83	138.54	39.10
PI 69 (2)	13.2	1.80	13.56	78.84	5.91 (1)
PI 70 (2)	15.3	2.32	15.22	111.06	43.02 (1)
PI 74 (1)	14.7	1.74	11.84	110.42	24.16
PI 78 (2)	15.9	----	-----	153.35	114.81
n	27	26	26	27	27
Grand Mean	14.3	2.14	15.11	149.82	53.70

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix D. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), testes (mg.), and vesicular glands (mg.) for II males.

Replicates	Body Wt.	Adrenal Glands		Testes	Vesiculars
		Absolute	Relative		
II 4 (2)*	14.9	1.54	10.36	252.54	111.83
II 7 (1)	13.9	1.82	13.09	254.46	128.61
II 8 (2)	23.6	2.23	9.47	324.69	135.66
II 10 (2)	14.0	2.27 (1)	14.55 (1)	187.22 (1)	109.99
II 16 (1)	20.0	3.19	15.95	285.55	153.05
II 17 (2)	12.1	2.38	19.68	114.43	12.17
II 21 (3)	13.3	1.30	9.77	115.55	29.29
II 24 (1)	11.2	3.15	28.13	15.79	0.70
II 31 (2)	16.4	1.99	12.11	209.80 (1)	47.63
II 34 (3)	14.6	1.58	10.83	199.57	78.57
II 35 (2)	14.6	2.75	18.88	148.74	28.83
II 39 (1)	15.5	2.00	12.90	165.49	48.53
II 51 (3)	14.3	1.72	11.95	144.71 (2)	26.42
II 53 (1)	15.1	2.03	13.44	229.32	88.50
II 56 (1)	15.0	1.80	12.00	79.10	9.35
II 57 (2)	12.6	1.86	14.71	42.13	1.47 (1)
II 58 (1)	14.4	1.39	9.65	83.73	2.00
II 61 (2)	15.7	1.79	11.39	174.25	125.23
II 62 (3)	14.2	2.33 (2)	16.62 (2)	64.60	3.61
II 65 (1)	16.1	2.30	14.29	179.77	113.30
II 66 (1)	12.5	2.37	18.96	79.50	1.82
II 70 (1)	11.8	2.32	19.66	------	3.72
II 74 (1)	13.8	2.23	16.16	125.35	35.46
n	23	23	23	22	23
Grand Mean	14.8	2.10	14.55	158.01	56.34

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix E. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), ovaries (mg.), and uteri plus oviducts (mg.) for PP nulliparous females.

Replicates	Body Wt.	Adrenal Glands Absolute	Adrenal Glands Relative	Ovaries	Uteri Plus Oviducts
PP 1 (3)*	12.3	1.84	14.97	6.87	16.88
PP 2 (4)	12.1	2.40	20.20	3.79	9.72
PP 3 (1)	10.9	2.94	26.97	1.23	3.84
PP 4 (3)	13.5	1.92	14.22	6.47	12.58
PP 5 (2)	12.6	2.08	16.61	5.32	26.58
PP 6 (2)	13.0	2.01 (1)	13.40 (1)	3.86	10.67
PP 7 (6)	12.3	2.19	18.14	4.49 (5)	18.26 (5)
PP 8 (6)	11.7	2.71 (4)	22.41 (4)	2.97	6.93
PP 9 (6)	12.4	1.89 (5)	15.17 (5)	6.35	17.11
PP 10 (5)	14.6	1.68	11.67	5.45 (4)	15.66 (4)
PP 11 (2)	13.0	2.13	16.33	6.99	19.28
PP 13 (3)	11.3	2.41 (2)	20.23 (2)	6.92	17.60
n	12	12	12	12	12
Grand Mean	12.5	2.18	17.53	5.06	14.59

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix F. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), ovaries (mg.), and uteri plus oviducts (mg.) for IP nulliparous females.

Replicates	Body Wt.	Adrenal Glands		Ovaries	Uteri Plus Oviducts
		Absolute	Relative		
IP 1 (1)*	12.5	1.59	12.72	6.28	16.33
IP 2 (2)	13.3	2.08	15.61	4.83	7.26
IP 3 (2)	14.5	1.78	12.31	5.73	28.58
IP 4 (6)	12.7	2.14	16.99	4.41	17.90
IP 5 (1)	13.1	1.65	12.60	7.24	41.48
IP 6 (3)	11.6	2.20 (1)	16.92 (1)	4.95	14.05
IP 7 (3)	13.1	1.62 (2)	12.06 (2)	5.05	28.24
IP 8 (4)	12.4	2.24	15.71	3.81	8.72
IP 9 (5)	14.7	1.93	13.24	7.36	36.81
IP 10 (5)	13.5	2.04	15.41	7.05	21.45
IP 11 (1)	14.8	1.47	9.93	8.31	31.15
IP 13 (3)	14.5	1.94	13.27	6.34	31.97
n	12	12	12	12	12
Grand Mean	13.4	1.89	13.90	5.95	23.66

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix G. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), ovaries (mg.), and uteri plus oviducts (mg.) for PI nulliparous females.

Replicates	Body Wt.	Adrenal Glands		Ovaries	Uteri Plus Oviducts
		Absolute	Relative		
PI 4 (3)*	14.0	2.23	15.84	5.19 (2)	23.96 (2)
PI 6 (1)	11.4	1.83	16.05	4.85	8.94
PI 7 (1)	11.7	1.63	13.93	2.44	7.45
PI 13 (1)	11.0	2.34	21.27	3.79	7.42
PI 17 (1)	12.8	2.13	16.64	2.02	3.74
PI 20 (1)	11.6	2.68	23.10	4.08	10.30
PI 21 (1)	13.9	1.46	10.50	4.90	10.51
PI 24 (2)	12.1	2.08	17.19	3.18	7.64
PI 31 (2)	16.0	2.58	16.09	9.41	23.12
PI 35 (1)	14.1	2.24	15.89	5.39	29.32
PI 51 (1)	11.0	2.25	20.45	1.61	3.83
PI 52 (1)	14.7	2.14	14.56	10.78	54.50
PI 56 (1)	13.1	1.92	14.66	3.79	11.22
PI 57 (1)	13.9	2.93	21.08	5.50	6.79
PI 58 (2)	12.8	2.23	17.11	6.85	13.23
PI 62 (1)	12.1	1.72	10.44	4.25	6.19
PI 65 (1)	10.9	1.82	10.39	4.03	6.36
PI 78 (1)	16.2	2.64	16.30	7.51	19.19
n	18	18	18	18	18
Grand Mean	13.0	2.16	16.19	4.98	14.10

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix H. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), ovaries (mg.), and uteri plus oviducts (mg.) for II nulliparous females.

Replicates	Body Wt.	Adrenal Glands		Ovaries	Uteri Plus Oviducts
		Absolute	Relative		
II 6 (3)*	13.3	2.14	16.10	4.48	13.15
II 7 (2)	11.7	2.12 (1)	19.10 (1)	8.28	22.06
II 8 (1)	13.5	2.25	16.67	4.93	12.58
II 10 (1)	14.4	2.65	18.40	6.65	32.51
II 13 (2)	13.5	1.68	12.54	4.28	8.57
II 16 (1)	19.8	2.22	10.72	8.54	36.79
II 17 (2)	13.3	1.78 (1)	13.38 (1)	3.16	19.96
II 20 (2)	14.0	2.19	15.73	6.37	8.91
II 24 (2)	11.6	2.48	21.42	1.77	4.89
II 31 (1)	14.7	2.59	17.62	4.89	30.41
II 35 (1)	14.5	3.10	21.38	10.21	57.66
II 39 (2)	13.8	1.98 (1)	13.85 (1)	5.94 (1)	9.86 (1)
II 53 (1)	14.5	1.88	12.97	6.01	11.58
II 56 (1)	13.0	1.58	12.15	7.43	12.30
II 58 (2)	12.2	2.16	17.74	2.92	6.82
II 63 (3)	11.9	1.66	14.00	5.82	12.98
II 65 (2)	11.7	2.04	17.46	5.17	15.78
II 66 (1)	10.5	----	-----	2.37	6.45
II 69 (2)	12.1	1.86 (1)	16.17 (1)	2.13	5.12
II 70 (1)	12.4	2.24	18.06	3.20	5.24
II 78 (2)	12.3	2.21	17.92	1.46	5.63
n	21	20	20	21	21
Grand Mean	13.3	2.14	16.17	5.05	16.15

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix I. Summary of the analysis of variance of the mean weights of the body (gm.), absolute paired adrenals (mg.), testes (mg.), and vesicular glands (mg.) for males.

		B: Raised	
		Pop.	Pair
A: Born		A_1B_1	A_1B_2
	Pop.	PP n = 12	PI n = 26
		A_2B_1	A_2B_2
	Pair	IP n = 10	II n = 22

Organ	Source of Variation	Sum of Squares	Df	Mean Square	F
Body Wt.	A: Born: Pop-Pr	4.485	1	4.485	1.250
	B: Raised: Pop-Pr	23.917	1	23.917	6.664*
	A * B	0.403	1	0.403	0.112
	Error	236.881	66	3.589	
Absolute Adrenals	A: Born: Pop-Pr	0.000	1	0.000	0.001
	B: Raised: Pop-Pr	0.108	1	0.108	0.536
	A * B	0.044	1	0.044	0.219
	Error	13.276	66	0.201	
Testes	A: Born: Pop-Pr	723.078	1	723.078	0.186
	B: Raised: Pop-Pr	50697.102	1	50697.102	13.069**
	A * B	3496.262	1	3496.262	0.901
	Error	256019.504	66	3879.083	
Vesicular Glands	A: Born: Pop-Pr	30.711	1	30.711	0.014
	B: Raised: Pop-Pr	18794.640	1	18794.640	8.352*
	A * B	1163.084	1	1163.084	0.517
	Error	148525.622	66	2250.388	

*Significant at $P<0.05$.
**Significant at $P<0.01$.

Appendix J. Summary of the analysis of variance of the mean weights of the body (gm.), absolute paired adrenals (mg.), ovaries (mg.), and uteri plus oviducts (mg.) for nulliparous females.

		B: Raised	
		Pop.	Pair
A: Born	Pop.	A_1B_1 PP n = 12	A_1B_2 PI n = 18
	Pair	A_2B_1 IP n = 12	A_2B_2 II n = 20

Organ	Source of Variation	Sum of Squares	Df	Mean Square	F*
Body Wt.	A: Born: Pop-Pr	6.850	1	6.850	3.004
	B: Raised: Pop-Pr	0.935	1	0.935	0.410
	A * B	0.804	1	0.804	0.352
	Error	132.271	58	2.281	
Absolute Adrenals	A: Born: Pop-Pr	0.356	1	0.356	2.767
	B: Raised: Pop-Pr	0.187	1	0.187	1.453
	A * B	0.279	1	0.279	2.169
	Error	7.456	58	0.129	
Ovaries	A: Born: Pop-Pr	4.392	1	4.392	0.973
	B: Raised: Pop-Pr	2.640	1	2.640	0.585
	A * B	1.707	1	1.707	0.378
	Error	261.900	58	4.516	
Uteri Plus Oviducts	A: Born: Pop-Pr	495.510	1	495.510	3.660
	B: Raised: Pop-Pr	207.690	1	207.690	1.534
	A * B	156.360	1	156.360	1.155
	Error	7853.092	58	135.398	

*All F ratios were non-significant at $P < 0.05$.

Appendix K. Hartley F_{max} test for homogeneity of variance for mean body and organ weights of males and nulliparous females respectively.

Sex	Df	Calculated F_{max} Values				F_{max} Values from Table***
		Body Wt.	Absolute Adrenals	Testes or Ovaries	Vesiculars or Uteri Plus Oviducts	
Males	4, 26	4.35**	2.90*	5.81**	4.33**	2.88 (5%) 3.70 (1%)
Null. Females	4, 20	3.40*	2.22	3.07	4.77**	3.29 (5%) 4.30 (1%)

*Significant at $P < 0.05$.
**Significant at $P < 0.01$.
***Winer (1962), p. 653.

Appendix L. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), testes (mg.), and vesicular glands (mg.) for PI and II males respectively exposed to starvation stress.

Replicates	Body Wt.	Adrenal Glands		Testes	Vesiculars
		Absolute	Relative		
PI 2 (3)*	15.2	2.22	14.51	282.89	115.66
PI 5 (1)	19.9	2.04	10.25	221.89	110.75
PI 9 (2)	17.0	1.84	10.79	253.92	128.54
PI 11 (1)	14.5	1.87	12.90	100.37	5.20
PI 26 (3)	15.5	2.08	13.36	117.89	41.09
PI 32 (1)	10.6	2.90	27.36	89.66	------
PI 36 (2)	14.4	1.67	11.54	103.64	22.33
PI 42 (2)	16.6	2.60	15.77	252.95	87.62
PI 48 (2)	13.9	1.79	12.86	261.10	115.42
PI 49 (1)	14.7	1.59	10.82	185.51	76.63
PI 59 (2)	14.1	2.38 (1)	17.25 (1)	186.61 (1)	67.45
n	11	11	11	11	10
Grand Mean	15.1	2.09	14.31	186.95	77.07
II 1 (2)	12.8	1.77	13.82	219.43	94.07
II 2 (1)	16.2	1.94	11.98	237.07	93.97
II 5 (1)	19.5	3.41	17.49	277.53	126.90
II 11 (2)	11.3	2.02 (1)	16.03 (1)	98.33	3.39
II 26 (2)	13.2	1.33	10.14	99.66	8.29
II 32 (2)	18.7	----	-----	225.51	87.55
II 36 (1)	14.2	2.22	15.63	328.14	60.46
II 42 (1)	14.3	----	-----	180.04	74.96
II 48 (2)	16.9	2.53	14.86	313.40	212.40
II 49 (2)	14.4	2.26	15.64	197.02	54.48
II 59 (2)	16.8	2.00 (1)	11.05 (1)	212.05	84.84
n	11	9	9	11	11
Grand Mean	15.3	2.16	14.07	217.11	81.94

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix M. The mean and grand mean weights of the body (gm.), absolute and relative paired adrenal glands (mg.), ovaries (mg.), and uteri plus oviducts (mg.) for PI and II nulliparous females respectively exposed to starvation stress.

Replicates	Body Wt.	Adrenal Glands Absolute	Adrenal Glands Relative	Ovaries	Uteri Plus Oviducts
PI 1 (3)*	13.4	1.91 (2)	15.61 (2)	4.58	17.95
PI 5 (1)	13.9	1.37	9.86	7.36	66.12
PI 11 (1)	13.7	1.86	13.58	7.63	27.23
PI 22 (1)	11.8	2.08	17.63	2.68	6.49
PI 32 (1)	11.9	1.42	11.93	4.83	19.06
PI 36 (1)	12.2	1.77	14.51	3.33	6.71
PI 48 (1)	10.8	2.28	21.11	1.68	4.67
PI 49 (2)	12.0	2.25	18.77	7.33	18.53
n	8	8	8	8	8
Grand Mean	12.5	1.87	15.38	4.93	20.85
II 1 (1)	----	1.27	-----	7.44	14.43
II 2 (1)	13.1	2.19	16.72	4.48	24.47
II 5 (2)	14.8	2.72	18.44	9.51	57.68
II 9 (2)	16.1	2.53	15.67	6.61	12.06
II 11 (1)	11.5	1.48	12.87	5.15	21.84
II 22 (3)	12.8	2.12	13.47	3.11	7.94
II 32 (1)	14.7	1.69	11.50	6.93	33.74
II 36 (1)	12.2	----	-----	5.91	10.78
II 42 (2)	12.3	1.90 (1)	13.67 (1)	4.23	9.67
II 49 (1)	14.3	1.69	11.82	5.78	12.76
n	9	9	8	10	10
Grand Mean	13.5	1.95	14.27	5.92	20.54

*Number in parentheses represents mice used in computing all mean organ weights for the replicate unless otherwise indicated.

Appendix N. T test comparisons of the mean body (gm.) and organ weights (mg.) and their standard errors of PI starved (PI-S) versus PI non-starved (PI-N) and II starved (II-S) versus II non-starved (II-N) males and nulliparous females respectively.

Sex	Comparisons	Body Wt.			Absolute Adrenals			Relative Adrenals			Testes or Ovaries			Vesiculars or Uteri Plus Oviducts		
		n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P	n	$\bar{x} \pm$ S.E.	P
Males	PI-S	11	15.12 ± 0.68	NS	11	2.09 ± 0.12	NS	11	14.31 ± 1.45	NS	11	186.94 ± 22.04	<0.1	10	77.07 ± 13.50	NS
	PI-N	27	14.25 ± 0.28		26	2.14 ± 0.09		26	15.11 ± 0.51		27	144.81 ± 10.42		27	53.70 ± 9.92	
	II-S	11	15.30 ± 0.76	NS	9	2.16 ± 0.17	NS	9	14.07 ± 0.83	NS	11	217.10 ± 22.44	<0.05	11	81.93 ± 17.11	NS
	II-N	23	14.76 ± 0.54		23	2.10 ± 0.10		23	14.54 ± 0.91		22	158.01 ± 17.32		23	56.33 ± 10.98	
Null. Females	PI-S	8	12.46 ± 0.37	NS	8	1.87 ± 0.12	<0.1	8	15.37 ± 1.30	NS	8	4.92 ± 0.81	NS	8	20.84 ± 7.03	NS
	PI-N	18	12.96 ± 0.38		18	2.16 ± 0.09		18	16.19 ± 0.86		18	4.97 ± 0.56		18	14.09 ± 2.94	
	II-S	9	13.53 ± 0.50	NS	9	1.95 ± 0.16	NS	8	14.27 ± 0.86	NS	10	5.92 ± 0.58	NS	10	20.53 ± 4.84	NS
	II-N	21	13.27 ± 0.41		20	2.14 ± 0.08		20	16.16 ± 0.66		21	5.05 ± 0.52		21	16.15 ± 2.90	

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